

**Supplemental Material:**

**Dioxin Exposure and Age of Pubertal Onset Among Russian Boys**

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**Supplemental Material, Table 1: Adjusted<sup>a</sup> change in mean age at pubertal onset (months) and 95% confidence intervals by quartiles of serum dioxins, furans, and PCBs among Chapaevsk boys (n=453)**

Adjusted Change in Mean Age at Onset in Months (95% Confidence Interval)				
Organochlorine Quartiles	Toxic Equivalent Measures		Concentration Measures	
	TV>3ml <sup>b</sup>	G2+ <sup>b</sup>	TV>3ml <sup>b</sup>	G2+ <sup>b</sup>
<u>Total TEQ (pg TEQ/g lipid)</u>				
Q1 (< 14)	Ref.	Ref.	N/A <sup>c</sup>	N/A <sup>c</sup>
Q2 (14 -<20)	-0.9 (-7.2, 5.5)	4.5 (-2.0, 11.0)		
Q3 (20 -<30)	0.7 (-5.5, 7.0)	2.0 (-4.5, 8.4)		
Q4 (30 - 175)	3.3 (-2.7, 9.4)	2.5 (-3.8, 8.7)		
p-trend	0.22	0.65		
<u>TCDD (pg TEQ/g lipid)<sup>d</sup></u>				
Q1 (< 1.3)			Ref.	Ref.
Q2 (1.3 - 2.7)			1.2 (-4.6, 7.1)	0.1 (-6.0, 6.2)
Q3 (2.8 - 3.9)			2.5 (-3.5, 8.5)	-0.7 (-6.9, 5.5)
Q4 (4.0 - 45)			5.7 (-0.6, 11.9)	0.0 (-6.4, 6.4)
p-trend			0.07	0.94
<u>PCDD TEQ (pg TEQ/g lipid)</u>				
Q1 (< 5)	Ref.	Ref.	Ref.	Ref.
Q2 (5 - 7.9)	3.5 (-2.6, 9.6)	6.3 (0.0, 12.6)	1.7 (-4.3, 7.6)	1.4 (-4.9, 7.6)
Q3 (8 - 12.9)	8.0 (2.1, 13.8)	6.6 (0.5, 12.7)	1.5 (-4.4, 7.5)	-1.0 (-7.3, 5.2)
Q4 (13 - 90)	6.7 (0.8, 12.6)	4.0 (-2.1, 10.1)	7.3 (1.2, 13.4)	-0.2 (-6.5, 6.1)
p-trend	0.01	0.21	0.03	0.77
<u>PCDF TEQ (pg TEQ/g lipid)</u>				
Q1 (< 3)	Ref.	Ref.	Ref.	Ref.
Q2 (3 - 3.9)	-3.3 (-9.5, 2.9)	3.6 (-2.8, 10.0)	4.0 (-1.9, 9.8)	3.9 (-2.1, 9.9)
Q3 (4 - 6.9)	-1.6 (-7.6, 4.4)	-0.9 (-7.1, 5.3)	3.3 (-2.6, 9.2)	1.0 (-5.1, 7.2)
Q4 (7 - 154)	2.4 (-3.9, 8.8)	4.7 (-1.7, 11.2)	6.6 (0.6, 12.6)	2.8 (-3.4, 9.0)
p-trend	0.38	0.38	0.05	0.54
<u>co-PCB TEQ (pg TEQ/g lipid)</u>				
Q1 (<4.5)	Ref.	Ref.	Ref.	Ref.
Q2 (4.5 - 6.4)	-4.7 (-10.6, 1.1)	-3.8 (-9.8, 2.2)	-3.6 (-9.5, 2.3)	-2.5 (-8.6, 3.6)
Q3 (6.5 - 9.4)	-2.1 (-8.3, 4.1)	0.1 (-6.2, 6.4)	1.8 (-4.1, 7.7)	1.6 (-4.5, 7.7)
Q4 (9.5 - 67)	-1.0 (-7.1, 5.1)	-1.6 (-7.8, 4.6)	3.6 (-2.4, 9.6)	0.4 (-5.8, 6.7)
p-trend	0.97	0.92	0.11	0.61
<u><math>\Sigma</math>PCBs (ng/g lipid)<sup>e</sup></u>				
Q1 (< 175)	N/A <sup>c</sup>	N/A <sup>c</sup>	Ref.	Ref.
Q2 (175 -<250)			-4.7 (-10.9, 1.5)	-1.6 (-7.9, 4.7)
Q3 (250 -<400)			-2.9 (-9.0, 3.2)	-3.0 (-9.2, 3.3)
Q4 (400 - 4248)			-1.4 (-7.6, 4.8)	-3.7 (-10.1, 2.7)
p-trend			0.79	0.23
<u><math>\Sigma</math>PCBs (ng/g lipid)<sup>e</sup></u>				

**Supplemental Material, Table 1 (continued):**

<sup>a</sup>Adjusted for: birth weight, gestational age, parental education, household income, 8/9-year diet (total calories, %protein, %fat), blood lead  $\geq 5 \mu\text{g}/\text{dl}$ , maternal pregnancy alcohol intake, baseline height and BMI.

<sup>b</sup>Testicular volume (TV) $>3\text{ml}$ ; genitalia staging  $\geq 2$  (G2+).

<sup>c</sup>Concentration or TEQ measures not applicable.

<sup>d</sup>TCDD TEQ is identical to TCDD concentration.

<sup>e</sup>n=448.

**Supplemental Material, Table 2: Adjusted (*including adjustment for non-co-planar PCBs*) hazard ratios (HRs)<sup>a</sup> and 95% confidence intervals for associations of serum dioxins, furans, and co-planar PCBs with pubertal onset between ages 8-12 years among Chapaevsk boys (n=448)**

Adjusted HR (95% Confidence Interval)			
Organochlorine Quartiles	Toxic Equivalent Measures (adjusted for ΣPCB quartiles)	Concentration Measures (adjusted for ΣPCB quartiles)	
	TV>3ml <sup>b</sup>	G2+ <sup>b</sup>	TV>3ml <sup>b</sup>
<u>Total TEQ (pg TEQ/g lipid)</u>			
Q1 (< 14)	1.00	1.00	N/A <sup>c</sup>
Q2 (14 -<20)	0.88 (0.59, 1.32)	0.71 (0.50, 1.02)	N/A <sup>c</sup>
Q3 (20 -<30)	0.75 (0.48, 1.18)	0.70 (0.46, 1.06)	
Q4 (30 - 175)	0.63 (0.38, 1.06)	0.66 (0.41, 1.05)	
p-trend	0.07	0.12	
<u>TCDD (pg TEQ/g lipid)<sup>d</sup></u>			
Q1 (< 1.3)	1.00	1.00	
Q2 (1.3 - 2.7)	0.94 (0.68, 1.32)	1.00 (0.73, 1.36)	
Q3 (2.8 - 3.9)	0.80 (0.56, 1.15)	0.98 (0.71, 1.35)	
Q4 (4.0 - 45)	0.62 (0.41, 0.93)	0.99 (0.69, 1.44)	
p-trend	0.02	0.94	
<u>PCDD TEQ (pg TEQ/g lipid)</u>			
Q1 (< 5)	1.00	1.00	1.00
Q2 (5 - 7.9)	0.78 (0.55, 1.11)	0.75 (0.55, 1.04)	0.88 (0.62, 1.25)
Q3 (8 - 12.9)	0.51 (0.35, 0.73)	0.71 (0.51, 0.98)	0.84 (0.58, 1.21)
Q4 (13 - 90)	0.59 (0.39, 0.90)	0.84 (0.59, 1.21)	0.64 (0.43, 0.95)
p-trend	0.001	0.22	0.03
<u>PCDF TEQ (pg TEQ/g lipid)</u>			
Q1 (< 3)	1.00	1.00	1.00
Q2 (3 - 3.9)	1.14 (0.78, 1.65)	0.79 (0.55, 1.11)	0.84 (0.59, 1.19)
Q3 (4 - 6.9)	0.96 (0.64, 1.46)	0.89 (0.61, 1.30)	0.80 (0.54, 1.17)
Q4 (7 - 154)	0.79 (0.49, 1.26)	0.61 (0.40, 0.96)	0.64 (0.41, 0.99)
p-trend	0.25	0.06	0.05
<u>co-PCB TEQ (pg TEQ/g lipid)</u>			
Q1 (<4.5)	1.00	1.00	1.00
Q2 (4.5 - 6.4)	1.20 (0.85, 1.60)	1.07 (0.78, 1.47)	1.09 (0.77, 1.52)
Q3 (6.5 - 9.4)	1.14 (0.77, 1.71)	0.85 (0.59, 1.23)	0.74 (0.51, 1.08)
Q4 (9.5 - 67)	1.02 (0.64, 1.62)	0.84 (0.55, 1.28)	0.68 (0.44, 1.04)
p-trend	0.91	0.27	0.05
<u>co-PCB (pg/g lipid)</u>			
			1.00
			0.98 (0.71, 1.34)
			0.73 (0.52, 1.03)
			0.67 (0.46, 0.98)
			0.02

<sup>a</sup>Adjusted for: birth weight, gestational age, parental education, household income, 8/9-year diet (total calories, %protein, %fat), blood lead ≥5 µg/dl, maternal pregnancy alcohol intake, baseline height and BMI, and non-co-planar PCBs (ΣPCBs).

<sup>b</sup>Testicular volume (TV)>3ml; genitalia staging ≥2 (G2+).

<sup>c</sup>Concentration or TEQ measures not applicable.

<sup>d</sup>TCDD TEQ is identical to TCDD concentration.

**Supplemental Material, Table 3: Adjusted hazard ratios (HRs)<sup>a</sup> and 95% confidence intervals for associations of serum  $\Sigma$ PCBs with pubertal onset between ages 8-12 years among Chapaevsk boys (including adjustment for dioxins, furans, and co-planar PCBs, n=448)**

ΣPCB Quartiles (ng/g lipid)	Adjusted HR (95% Confidence Interval)			
	Adjusted for Toxic Equivalent Measures (pg TEQ/g lipid)		Adjusted for Concentration Measures (pg/g lipid)	
	TV>3ml <sup>b</sup>	G2+ <sup>b</sup>	TV>3ml <sup>b</sup>	G2+ <sup>b</sup>
<b>ΣPCBs</b>				
<b>(+adjusted Total TEQ)</b>				
Q1 (< 175)	1.00	1.00	N/A <sup>c</sup>	N/A <sup>c</sup>
Q2 (175 -<250)	1.36 (0.91, 2.04)	1.21 (0.84, 1.74)		
Q3 (250 -<400)	1.41 (0.90, 2.22)	1.46 (0.96, 2.21)		
Q4 (400 - 4248)	1.41 (0.82, 2.42)	1.51 (0.94, 2.43)		
<i>p-trend</i>	0.23	0.08		
<b>ΣPCBs</b>				
<b>(+adjusted TCDD TEQ)<sup>d</sup></b>				
Q1 (< 175)			<b>(+adjusted TCDD concentration)</b>	
Q2 (175 -<250)			1.00	1.00
Q3 (250 -<400)			1.26 (0.88, 1.79)	1.01 (0.74, 1.40)
Q4 (400 - 4248)			1.33 (0.91, 1.92)	1.15 (0.81, 1.61)
<i>p-trend</i>			1.27 (0.85, 1.92)	1.14 (0.80, 1.64)
			0.23	0.42
<b>ΣPCBs</b>				
<b>(+adjusted PCDD TEQ)</b>				
Q1 (< 175)	1.00	1.00	<b>(+adjusted PCDD concentration)</b>	
Q2 (175 -<250)	1.45 (1.01, 2.09)	1.10 (0.80, 1.52)	1.00	1.00
Q3 (250 -<400)	1.51 (1.03, 2.21)	1.26 (0.90, 1.76)	1.25 (0.87, 1.79)	1.02 (0.73, 1.42)
Q4 (400 - 4248)	1.34 (0.87, 2.07)	1.19 (0.81, 1.73)	1.25 (0.86, 1.80)	1.14 (0.82, 1.58)
<i>p-trend</i>	0.15	0.28	1.18 (0.79, 1.75)	1.15 (0.81, 1.62)
			0.45	0.82
<b>ΣPCBs</b>				
<b>(+adjusted PCDF TEQ)</b>				
Q1 (< 175)	1.00	1.00	<b>(+adjusted PCDF concentration)</b>	
Q2 (175 -<250)	1.22 (0.83, 1.79)	1.13 (0.79, 1.60)	1.00	1.00
Q3 (250 -<400)	1.23 (0.81, 1.85)	1.31 (0.90, 1.92)	1.32 (0.91, 1.91)	1.11 (0.79, 1.55)
Q4 (400 - 4248)	1.17 (0.73, 1.88)	1.48 (0.96, 2.27)	1.30 (0.87, 1.94)	1.27 (0.89, 1.82)
<i>p-trend</i>	0.57	0.06	1.29 (0.82, 2.03)	1.38 (0.92, 2.06)
			0.31	0.09
<b>ΣPCBs</b>				
<b>(+adjusted co-PCB TEQ)</b>				
Q1 (< 175)	1.00	1.00	<b>(+adjusted co-PCB concentration)</b>	
Q2 (175 -<250)	1.15 (0.80, 1.66)	1.03 (0.74, 1.44)	1.00	1.00
Q3 (250 -<400)	1.08 (0.73, 1.61)	1.26 (0.87, 1.81)	1.31 (0.91, 1.87)	1.10 (0.79, 1.53)
Q4 (400 - 4248)	1.00 (0.61, 1.62)	1.33 (0.87, 2.03)	1.36 (0.93, 2.00)	1.37 (0.97, 1.94)
<i>p-trend</i>	0.99	0.15	1.33 (0.85, 2.08)	1.50 (1.02, 2.22)
			0.20	0.03

### **Supplemental Material, Table 3 (continued):**

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<sup>a</sup>Adjusted for: birth weight, gestational age, parental education, household income, 8/9-year diet (total calories, %protein, %fat), blood lead  $\geq 5 \mu\text{g}/\text{dl}$ , maternal pregnancy alcohol intake, baseline height and BMI, and dioxins, furans, or co-PCBs as specified above.

<sup>b</sup>Testicular volume (TV) $>3\text{ml}$ ; genitalia staging  $\geq 2$  (G2+).

<sup>c</sup>Concentration or TEQ measures not applicable.

<sup>d</sup>TCDD TEQ is identical to TCDD concentration.